WHAT IS CLAIMED IS

1. An optical repeater, comprising:

an optical fiber configured to be a Raman amplifying medium and having an input end and an output end and configured to receive a wavelength division multiplex, WDM, optical signal having a signal bandwidth of at least 20 nm;

an output optical transmission fiber connected to the output end of the optical fiber;

an input optical transmission fiber connected to the input end of the optical fiber;

a WDM coupler configured to optically couple light to the optical fiber,

at least one of an input EDFA connected in series with input end of the optical fiber and an output EDFA connected in series with output end of the optical fiber; and

a plurality of pumping light sources each configured to provide pump light having a central wavelength to the optical fiber via the WDM coupler, wherein

the optical fiber is configured to have a different dispersion characteristic than at least one of the output optical transmission fiber and the input optical transmission fiber, and

the central wavelength of each of the pumping light sources are different from each other and a wavelength interval between the plurality of pumping light sources or greater than 6 nm and smaller than 35 nm.

2. The optical repeater of Claim 1, wherein:

the optical fiber comprises at least one of a single mode fiber, SMF, and a dispersion compensation fiber, DCF.

3. The optical repeater of Claim 2, wherein:

the at least one of an input EDFA and an output EDFA comprises only one input EDFA; and

the optical fiber is connected to an output end of the only one input EDFA.

4. The optical repeater of Claim 1, wherein:

at least one of the plurality of pumping light sources is configured to have an adjustable optical output level that produces an adjustable gain in the optical fiber; and

the at least one of an input EDFA and an output EDFA is configured to have an adjustable gain.

5. The optical repeater of Claim 1, wherein:

the optical fiber has a Raman wavelength gain dependency and the at least one of an input EDFA and an output EDFA is configured have an EDFA wavelength gain dependency, wherein

an optical output of the plurality of pump light sources is set so that the Raman wavelength gain dependency configured to at least partially offset

the EDFA wavelength gain dependency.

6. The optical repeater of Claim 1, wherein:

the at least one of an input EDFA and an output EDFA comprises only one output EDFA; and

the optical fiber is connected to an input end of the only one output EDFA.

7. The optical repeater of Claim 1, wherein:

the at least one of an input EDFA and an output EDFA comprises only one output EDFA and only one input EDFA, and

the optical fiber is connected between the only one output EDFA and the only one input EDFA.

8. The optical repeater of Claim 1, further comprising:

a monitor signal detecting and control signal generating circuit connected between the optical fiber and the plurality of pumping light sources, and configured to monitor and adjust levels of the pump light so as to control a gain applied to the optical signal by the optical fiber.

9. The optical repeater of Claim 8, wherein:

the monitor signal detecting and control signal generating circuit is configured to maintain a pre-determined constant difference between an input level and an output level of a plurality of WDM signals.

10. The optical repeater of Claim 9, wherein:

the monitor signal detecting and control signal generating circuit is connected to the input end of the optical fiber.

11. The optical repeater of Claim 9, wherein:

the monitor signal detecting and control signal generating circuit is connected to the output end of the optical fiber.

12. The optical repeater of Claim 11, wherein:

the at least one of an input EDFA and an output EDFA consists of one of an input EDFA and an output EDFA, said one of an input EDFA and an output EDFA being configured to exhibit at least one of a constant optical amplifier gain control and a constant optical amplifier output control; and

the plurality of pumping light sources is configured to be independently controlled by the monitor signal detecting and control signal generating circuit to reduce an inter-channel optical repeater output signal deviation.

13. The optical repeater of Claim 1, further comprising:

a second WDM coupler connected to one of the input optical transmission fiber and the output optical transmission fiber and configured to receive a residual pumping light from the plurality of pumping light sources.

14. The optical repeater of Claim 13, further comprising:

a third WDM coupler connected to another one of the input optical transmission fiber and the output optical transmission fiber and configured to receive a residual pumping light from the plurality of pumping light sources and to launch said residual pumping light into the another one of the input optical transmission fiber and the output optical transmission fiber.

15. The optical repeater of Claim 1, further comprising:

a second WDM coupler connected to one of the at least one of the at least one of an input EDFA and an output EDFA and configured to receive a residual pumping light from the plurality of pumping light sources.

16. The optical repeater of Claim 15, further comprising:

a third WDM coupler connected to another one of the at least one of an input EDFA and an output EDFA and configured to receive a residual pumping light from the plurality of pumping light sources.

17. The optical repeater of Claim 1, wherein:

said optical fiber is configured to compensate for chromatic dispersion of the WDM optical signal caused by the input optical transmission fiber.

18. The optical repeater of Claim 1, wherein:

an amount of gain applied to the optical signal resulting from the

pump light from the plurality pumping light sources is set to compensate for an attenuation of the optical signal in at least one of the DCF and the input optical transmission fiber.

19. The optical repeater of Claim 1, wherein:

an amount of gain applied to the optical signal resulting from the pump light from the plurality of pumping light sources is set to suppress an amplification fluctuation of the EDFA and to maintain a repeater gain flatness.

20. A method for optically amplifying a wavelength division multiplex optical signal in an optical fiber configured to be a Raman amplifying medium, comprising steps of:

generating a plurality of pump lights;

injecting the plurality of pump lights to an optical fiber configured to be a Raman amplifying medium while the wavelength division multiplex optical signal propagates though the optical fiber; and

controlling respective levels of the plurality of pump lights to adjust at least one of a wavelength-dependent loss characteristic of the optical fiber and a wavelength-dependent noise characteristic of the optical fiber.

21. The method of Claim 20, wherein:

the optical fiber comprises at least one of a single mode fiber and a dispersion compensating fiber, DCF, having a predetermined non-linearity

characteristic;

the plurality of pumping light sources comprise four semiconductor lasers with fiber Bragg gratings, FBG, a polarization beam combiner, PBC, and a WDM coupler; and

the four semiconductor lasers are configured to generate pumping light at different wavelengths.

22. The method of Claim 20, further comprising a step of:

combining the pumping lights via a Mach-Zehnder interferometer wave combiner.

23. The method of Claim 22, further comprising steps of:

selectively applying a subset of the pumping lights to the amplification medium; and

selectively setting a uniform input power to each of the subset pumping lights, wherein

the subset of the pumping lights comprise a number of wavelengths from a short wavelength side of a pumping light band greater than another number of wavelengths at a long wavelength side of a pumping light band, and

the step of selectively applying a subset of the pumping lights is controlled to provide a substantially uniform gain.

24. A method for repeating a wavelength division multiplex optical

signal, comprising steps of:

providing a pump light from a plurality of pumping light sources to an optical fiber configured to be a Raman amplifying medium and to receive the wavelength division multiplex optical signal from an optical transmission fiber; and

amplifying the optical signal with at least one of the plurality of pump light sources and at least one EDFA connected in series with the optical fiber, wherein

said amplifying step includes wavelength-dependent amplification.

25. The method of Claim 24, wherein:

the optical fiber comprises at least one of a single mode fiber, SMF, and a dispersion compensation fiber.

26. The method of Claim 24, wherein:

at least one of the plurality of pumping light sources and the at least one EDFA are configured to impart an adjustable gain on the optical signal.

27. The method of Claim 26, further comprising a step of:

setting a gain of at least one of the plurality of pumping light sources and the at least one EDFA so as to at least partially offset a wavelength dependency of an EDFA gain.

28. The method of Claim 27, further comprising steps of:

detecting a monitor signal; and

controlling a signal generating circuit connected between the optical fiber and the plurality of pumping light so as to control a gain of the optical fiber.

29. The method of Claim 28, wherein:

the controlling step is configured to maintain a pre-determined difference between an input level and an output level of a plurality of WDM signals.

30. The method of Claim 24, further comprising steps of:

controlling a gain of a first EDFA and a second EDFA of the at least one EDFA to produce at least one of a constant optical amplifier gain control and a constant optical amplifier output control; and

independently controlling a gain of the plurality of pumping light sources to reduce an inter-channel optical repeater output signal deviation.

31. The method of Claim 24, further comprising a step of:

pumping a residual pumping light to the input optical transmission fiber through at least one of an input and an output side of the optical fiber.

32. The method of Claim 24, further comprising:

pumping a residual pumping light input to the at least one EDFA.

33. The method of Claim 25, wherein:

the plurality of pumping light sources is configured to compensate for a loss of signal in at least one of the dispersion compensation fiber and the optical transmission fiber.

34. The method of Claim 24, wherein:

the plurality of pumping light sources is configured to suppress a gain fluctuation of the EDFA and to maintain a repeater gain flatness.

35. A wavelength division multiplexed light optical amplifier, comprising:

an optical fiber configured to be a Raman amplifying medium;

a plurality of pump lights;

at least one EDFA;

means for injecting the plurality of pump lights to the optical fiber; and

means for controlling the plurality of pump lights to adjust at least one of a wavelength-dependent loss characteristic of the optical fiber and a wavelength-dependent noise characteristic of the optical fiber.

36. The amplifier of Claim 35, wherein:

the amplifying medium comprises at least one of a single mode fiber and a dispersion compensation fiber.

37. A wavelength division multiplex optical signal repeater, comprising:

an optical fiber configured to be a Raman amplifying medium;

a plurality of pump lights;

at least one EDFA;

means for providing a pump light from the plurality of pumping light sources to the optical fiber; and

means for wavelength-dependent amplifying the wavelength division multiplex optical signal with at least one of the plurality of pump lights and an EDFA connected in series with the optical fiber.

38. The repeater of Claim 37, wherein:

the optical fiber comprises at least one of a single mode fiber, SMF, and a dispersion compensation fiber.

39. A Raman amplifying medium comprising:

an optical fiber configured to guide therein a WDM optical signal having a signal bandwidth of at least 20 nm, wherein

said optical fiber is configured to receive WDM pump light having a predetermined pump bandwidth and to produce an amplification characteristic of a predetermined gain having less than 1 dB of ripple across an amplification bandwidth that is at least 20 nm and that overlaps said signal bandwidth, said pump light comprising light from a plurality of semiconductor lasers that produce multimode optical outputs having

respective center wavelengths separated from one another in an inclusive range of 6 nm through 35 nm.

40. The Raman amplifying medium of claim 39, wherein:

the optical fiber comprises at least one of a single mode fiber and a dispersion

compensation fiber.

41. The Raman amplifying medium of claim 39, wherein:

the optical fiber comprises a dispersion compensation fiber having a dispersion property of less than -20 ps/nm per 1 km.

42. The Raman amplifying medium of claim 39, wherein:

the optical fiber is configured to have a non linear index n2 of refraction equal to or

greater than 3.5×10^{-20} m^2/W.